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THE SOFT SCALE (COCCUS HESPERIDUM) INFESTING HOLLY ON VANCOUVER ISLAND

(A Preliminary Report)

by Harry Andison*

The soft scale (**Coccus hesperidum** (L.)) has become very prevalent on holly trees in many parts of the southern Vancouver Island district during the past year. It was first noticed in the vicinity of Victoria, B.C., during February, 1938; specimens were forwarded to the Division of Entomology at Ottawa, and were subsequently determined by Dr. Harold Morrison of Washington, D.C. Additional holly trees were examined during the course of the 1938 season when we observed the soft scale spreading very rapidly. A black fungus (probably **Meliola camelliae** Catt. with which this scale is associated) was found to be present wherever the scale infestations occurred. Specimens were found as far north as Duncan.

The establishment of the soft scale and the sooty-mold fungus on holly in British Columbia is a serious menace to the production and exportation of holly for the Christmas season. Plant quarantines restricting the free movement of the scale-infested holly, focussed the attention of the commercial growers upon this pest and created an immediate need for information upon its life habits and control.

Nature and Extent of Injury

The injury caused by the soft scales is due not only to the feeding by extracting of the juices from the plant but also to the sooty-mold fungus which develops in the honeydew that the scales secrete. This honeydew falls upon the upper surface of the leaves, stems and berries of the holly and such areas eventually become almost completely covered and blackened with the sooty coating of the fungus. Holly so affected is unsightly and is not saleable. Where infestations are severe, the smut-like covering is injurious to the tree by interfering with its respiration. The sugary exudation is also a means of dispersal of the scale, by causing them to adehre to the feet of perching birds which will then carry the scales to other trees. Ants constantly seen about the infested trees feeding on the honeydew during the spring and summer are also responsible for the rapid spread of the scale within an orchard.

Host Plants and Distribution

This species of scale, which was formerly placed in the genus **Lecanium**, has long been known to science, being one of the first of the soft scales to be studied and described. It is the commonest, most widely spread member of the sub-family **Coccinae** (9), occurring out of doors throughout the world in the tropical and sub-tropical regions,

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and in greenhouses in the cooler regions. Originally from Europe, it is also reported from Algiers, Japan, Australia, New Zealand, Chili, Hawaiian Islands, South Africa and North America (6). In North America it is common on ornamentals in the south west, infesting chiefly oleander in Arizona, Texas and New Mexico; in the coastal zones of Florida (9) and southern California (4) it is often a pest to young citrus trees. In northern regions, the soft scale has been present for a number of years as a major pest of greenhouse crops. Its establishment on holly in the Victoria district appears to be the first record of its occurrence in Canada as an economic pest of plants grown out of doors.

The food plants as recorded in literature number approximately seventy-five. Those of most economic importance are as follows: apple, apricot, box elder, clematis, citrus, grape, holly, English ivy, laurel, peach, pear, phlox, plum, poplar, rose and willow. Since February 1938, when this scale was first reported infesting English holly (**Ilex** sp.) at Victoria, B.C., we have also observed it on sweet bay (**Laurus** sp.) in this district, and on a species of ivy (**Hedera colchica**) at Duncan, B.C. Further survey work may disclose its appearance on some of the other hosts mentioned.

Life History and Habits

There appears to be more than one generation of the scale each year under Victoria conditions and many adults and nymphs in various degrees of maturity are present throughout the season on the same branch. In the citrus areas in California the soft scale has as many as four generations each year (8) and it is principally the trees less than six years old that are attacked. In contrast to this we find holly trees 15 years old and more are severely infested.

The females of this species are oval, flat, soft, turtle-shaped scales, changing in color with age, from transparent yellow to deepening shades of brown. The mother or adult female scale which gives birth to living young is very much swollen, becoming a stationary cap filled with small nymphs. The young nymphs are thin and transparent so that they are scarcely noticeable on the surface of the leaf or branch. The male scales are very slender, smaller and lighter in color than the mature females. The adult males are yellow, exceedingly minute two-winged flies.

These soft scales suck the sap from the tissues like the armoured scales do, but they move about and are able to withdraw their beak and insert it at will. All the immature stages are gregarious and migrate to and attack the tender new leaf and stem growth during the spring and early summer. During this period the insect develops and spreads rapidly, congregating along the midribs and large veins on the stems and on both sides of the leaves. As many as 140 scales of various sizes have been found developing on a single holly leaf, frequently becoming so thick as to overlap.

A concise report on the description and distinguishing characteristics of this scale is contained in "Scale Insects of Missouri", by Hollinger (5).

Control

In the citrus areas in some parts of the United States, natural enemies play an important part in keeping the scales from becoming a serious pest. The internal hymenopterous parasites **Aphycus flavus** Howard, **Microterys flavus** (Howard), **Coccophagus lecanii** (Fitch) (4), and **Coccophagus scutellarius** (Dalman) (1) are probably the principal ones. The fungus parasite Cuban Aschersonia (**A. cubensis** Berk. and Curt.) has also effectively controlled the scale in several places in southern Florida (9). Where the parasites do not check the scale infestations on citrus trees, the application of oil sprays is recommended as the best method of control.

Extensive tests conducted during the months of September and October at this laboratory, showed that an oil emulsion containing 2 per cent oil (viscosity 55, unsulfonated residue 80) in combination with nicotine sulphate 1 to 800, was not injurious in any way to the holly trees, and gave 95 to 100 per cent control of the soft scale.

Summary

The Soft Scale (**Coccus hesperidum** (L.)) was observed as an economic pest of holly in the southern region of Vancouver Island during February 1938. This is the first record of its occurrence in Canada as an economic pest of plants grown out of doors. Infested leaves, stems and berries eventually become covered with a sooty-mold fungus which develops in the honeydew secreted by the scales. Holly so affected is unsightly and is not saleable. Up to the present time in this region holly and sweet bay are the only plants found to be attacked and there appears to be more than one generation of scale developing. Additional survey work and life history studies are required to secure complete data. Spraying the infested trees during the fall months, using a 2 per cent oil emulsion with nicotine sulphate added, proved to be an effective method of control.

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A NOTE ON INSECTS AS DISSEMINATORS OF FUNGUS SPORES

by L. Colin Curtis*

The role of insects as disseminators of pathogenic organisms has long been recognized. However, greater attention appears to have been paid to those cases that involve internal, rather than external dissemination. The example under review in this paper presents a striking illustration of the possibilities of spore transmission in cases where the organisms are carried on the outer surface of the insect.

During the course of regular work in entomology at the University of British Columbia, a slide was made of both fore and hind wing of **Melanoplus mexicanus mexicanus** Sauss. **(Orthoptera, Locustidae)** from a specimen taken on meadowland on the University campus. Due to the fact that the wings were mounted in Berlese's mounting fluid, a medium which obviates the necessity for preliminary washing and dehydrating, the completed specimen was seen to have retained all its adherent debris, which proved upon inspection to consist almost entirely of the spores of a number of different fungi.

Due to the nature of the mount, an attempt at determination of the organisms involved was limited to a morphological basis, and culturing was out of the question. By this means, it was possible to trace the spores down only to genus. However, this was done, and the whole spore load was found to fall under five genera, as follows:

Heterosporium—Conidia two to several-septate, echinulate. Some species of this genus are destructive molds on carnation, hop, spinach, larch, and numerous **Liliaceae.**

Stemphylium—Conidia acrogenous, with muriform septation. This is a small genus, but includes pathogens of cucurbits and of wheat.

Macrosporium—Conidia muriform-septate and caudate. This genus includes species which cause black mold on various grasses, on crucifers, and on a wide range of garden plants.

Cladosporium or **Fusicladium**—Conidia ovoid, greenish or olivaceous, sparingly septate, acrogenous.

These two genera are not readily separable on a morphological basis. Between them they include many pathogenic species which attack drupaceous and pomaceous fruits, cucurbits, corn, oats, potatoes, tomatoes, and hardwoods.

Uromyces — One of the rusts, which attacks clover, alfalfa, and other leguminous fodder crops. Teliospores only were identified in the present instance.

While it is not suggested that all the spores observed represent pathogenic species, it is highly probable that many of them are harmful. That grasshoppers and other insects of like habitat may be a powerful factor in the spread of plant disease may, however, be judged from the following figures.

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Spore counts were made in a number of microscopic fields taken at random on both fore and hind wing with the results shown on the appended table.

Field	Hetero sporium	Stem-phyllium	Macro-sporium	Clado-sporium	Uromyces
1.	31	1	6	108	3
2.	31	..	..	56	5
3.	1	1	1	31	15
4.	4	1	3	21	..
5.	3	1	2	12	3
6.	6	..	..	33	10
7.	20	1	..	62	11
8.	13	2	1	29	2
9.	5	..	..	25	4
10.	10	..	..	22	4
Average per field	12.4	0.7	1.3	39.9	5.7
Average per mm^2	126.5	7.14	13.3	407.1	58.6

Total Average Spores per mm^2 — 612.6.

Taking a conservative estimate of 400 square millimeters for the total area of the exterior surfaces of a member of this species, one arrives at the interesting figure of 244,800 for the gross spore load per insect. Since concentrations of grasshoppers up to 1,000 per square yard have been reported in the case of severe infestations, it will be seen that the sport count per acre will run into astronomical figures.

If only a small proportion of this total should prove to be pathogenic and viable, it will provide ample inoculum for the area involved, and it will be conceded that the prairie farmer may have some cause for his pessimism when he complains that when the grasshoppers have finished with his grain, the rust comes in and completes the work of destruction.

The writer wishes to express his acknowledgements to Prof. F. Dickson, Dept. of Botany, University of British Columbia, for his assistance in the identification of the various spores, and to Prof. G. J. Spencer, Dept. of Zoology, for first calling attention to the importance of the phenomenon.

NOTES ON THE ECOLOGY OF DERMACENTOR ANDERSONI IN SOUTHERN ALBERTA

by George P. Holland*

During the period April 24 to July 31, 1938, in connection with the Rodent Plague and Rocky Mountain Spotted Fever Survey in Southern Alberta, considerable time was spent in the mass collecting of the tick **Dermacentor andersoni** Stiles. As a number of cases of Spotted Fever have come to the attention of medical men in Alberta during the past few years, the study of **D. andersoni,** which is the vector of this and other diseases, is a problem of no small importance. In the course of the season's work, notes were, therefore, accumulated on the habits and distribution of this important species.

Distribution:

To those who are familiar with ticks in the hilly regions of interior British Columbia, the southern Alberta prairie does not seem the ideal habitat for a tick population. Nevertheless, they were found to be widespread and extremely plentiful in some localities.

At the present time **D. andersoni** is known to occur from the southern border of Alberta, across the breadth of the province, and north at least to Red Deer (about 52° 15′ N. Lat.). The general opinion throughout the tick-infested areas seems to be that they are becoming increasingly abundant, and that they are progressing gradually northward. Ranchers and doctors around Hanna and Stanmore state that they did not know the wood-tick until during the last few years.

During the course of the survey a strip of country from Waterton Lakes in the west to the Cypress Hills in the east, and from Lethbridge and Medicine Hat, southward to the border was checked for the presence of ticks. Waterton Lakes National Park was found to be virtually tick-free (June 20th-29th). However, according to local residents this place is badly infested earlier in the spring, and the ticks at that time are a great nuisance. There is a great variety of natural hosts for young and adult stages,—marmots, rabbits, ground-squirrels (four species), chipmunks, tree squirrels, mice and weasels, as well as larger animals,—deer, bears, mountain-sheep and so on.

Very few ticks were found in the foothill regions, and as far east as Cardston, although there is no lack of hosts. Ranchers in the Cardston area are unfamiliar with the true ticks—knowing only the sheep ticks, or keds (Hippoboscidae). Careful checking of sheep, cattle and horses revealed no **D. andersoni,** and only very few were secured by dragging.

However, the short grass prairie from Milk River to Manyberries was found to be heavily infested, and the bulk of the season's collecting was done in this region—the south-east corner of Alberta.

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Hosts: Ticks here are fairly plentifully provided with quantity if not variety of hosts. Richardson's Ground Squirrel, **Citellus richardsoni** (Sabine), (the so-called Prairie Gopher) and the White-tailed Jack-rabbit, **Lepus townsendi campanius** Hollister, are fairly abundant and are probably the more important hosts for the larval and nymphal stages. The rabbits, in addition, pick up the adult ticks, as also must the native Pronghorn Antelope, **Antilocapra americana americana** (Ord), which is still fairly common in this part of the country. However, domestic sheep, cattle and horses are more important hosts of the adult stage.

Habitat and Ecology Notes:

While ticks were found sometimes in fair numbers on the open rangelands, the greatest quantity was secured in the vicinity of water. The old river-beds or coulees, which traverse the south country were nearly all infested to a greater or lesser degree. Shallow coulees did not yield so many ticks as did those with more steeply sloping sides, and the most ideal localities were not the wide bottomlands of these old river-beds, but the smaller, deeper draws which were tributary to the main coulee. In such places, ticks would generally be numerous, and after a little experience of collecting in this type of country it became readily possible to judge by the general appearance just which localities were best. As it is well known that ticks are sensitive to relative humidity it is not surprising that they favoured such places rather than the more open, dry and wind-swept areas.

The vegetation in the coulees varied with locality, but consisted chiefly of sage—**Artemisia cana,** rabbit-brush—**Chrysothamnus sp.,** Coralberry—**Symphoricarpos occidentalis,** and various grasses, all of which carried ticks. Strangely enough, ticks of one locality seemed to show a decided preference for one of these plants as a roosting place, whereas those in another area, apparently similar, would choose a different perch.. For instance, at Verdigris Coulee (10 miles east of Milk River), the ticks were found right on the short grass itself, and a tick drag (a piece of white flannelette, one yard square) placed flat on the ground would generally pick up two or three with each sweep. Only a few were taken from the sage or rabbit-brush.. At Manyberries Coulee the reverse was the case, and the grass yielded only a few ticks, most of them being collected from the low-lying bushes, especially those growing over gopher burrows.

While no apparatus was available for taking temperature or humidity readings, it was noted that best collecting occurred on dull, warm, humid days, especially just prior to rain. The ticks at this time were extremely active and readily brushed onto the drags. Collecting was poor on cold and windy days, or when it was particularly hot and dry. During extremes of heat and cold the ticks were generally too lethargic to gain a hold on the flannel drag, and if they did get on the cloth, would frequently let go and fall off before they could be secured and transferred to vials.

On an average warm day ticks did not become active until 9:30 or 10 a.m., and then collecting would be fair until noon. From noon

until 2:30 or 3 p.m., few ticks could be expected, but in the late afternoon and early evening, collecting would be at its peak. On occasion we dragged for ticks in the evening, and would be still picking them up when it became too dark to see.

In general it was only rarely that we happened to see a tick on its perch before it was picked up on the drag. One locality was found, however, where they could be seen fairly readily, clinging to the grass stems. This was at a dry creek bed, leading into Chin Coulee, five miles north of Etzikom. Here the grass was very sparse, and the clinging ticks, sometimes in groups of three or four, were silhouetted against the smooth dry mud of the old creek bed, and were seen quite readily. Nearly all were facing head downward, and hanging onto the grass blades with all pairs of legs. When approached closely, they immediately sensed the presence of the potential host and extended the first, second and fourth pairs of legs, hanging on by the third. If the drag cloth or one's hand were brushed by them they readily left their perches and climbed on.

During the earlier part of the season at Manyberries, it was noted that there was a preponderance of females. Sample groups counted showed a ratio of five females to two males. Later in the season this difference was not noted, and the two sexes were represented in fairly even proportions.

The ticks showed considerable variation in size. Some were really large, especially males, but others, of both sexes, were so stunted as to be very little removed in size from flat nymphs. In general, it may be said that they averaged smaller in size than ticks of the same species found in the interior dry belt of British Columbia.

In the course of the season three partly engorged female ticks (one, May 26th, Manyberries Creek; and two, June 2nd at the Dominion Range Station) were picked up on drags. This is a most unusual happening. Whether these ticks had been scratched off by the host or whether they had released of their own accord, finding some physiological condition not suited to their tastes in the blood of the host, leads to interesting conjecture. Perhaps they had been feeding on rabbits which were infected with tularaemia, and which had died before they could complete engorgement.

In south-east Alberta the tick season apparently commences in late March, depending on weather conditions, reaches its peak in May and early June, and comes to an end in July. A very few ticks were found to be still active in the Milk River country on July 8th, and some at Etzikom, July 13th.

Numbers of ticks secured:

Actual abundance of ticks in this country, of course, varied with locality, but in general they were plentiful. In Manyberries Coulee sometimes fifteen would be taken on a single drag over a ground-squirrel burrow. At "Big Coulee," just north of Manyberries, 1500 specimens were secured by two men in five and one-half hours. This was extremely good collecting, as part of this time was lost because of intermittent showers of rain. At Lone Tree and Geddes Coulees

(Dom. Range Exp. Station) two men collected 1750 ticks in a single day (June 2nd). In certain deep draws leading into the south side of Chin Coulee, just west of Foremost it was possible, under ideal conditions, for each man to pick up 150-200 ticks per hour! In one spot at Verdigris Coulee, east of Milk River, a most unusual situation was found where ticks were plentiful on the bare ground of a cattle trail. Here as many as 23 were taken on a single sweep of the drag cloth. Ordinarily it was quite a reliable rule that ticks were more common on the bushes bordering stock trails, but usually not many ticks would be found on the trail itself.

Due to the unusually wet spring of 1938, many days during the tick season were completely lost. However, about thirty-five days of suitable weather were devoted to tick collecting, and during this time nearly 22,000 specimens were obtained.

NEW RECORDS OF SIPHONAPTERA FOR BRITISH COLUMBIA

by George P. Holland*

In the course of checking over part of the collection of fleas at the Kamloops Laboratory, Dominion Department of Agriculture, Division of Entomology, five species have been established as new records for British Columbia. These follow:

Xenopsylla cheopis (Roths). 1903—See details below.

Opisocrostis tuberculatus (Baker) 1904.
Taken from Columbia ground squirrel, **Citellus columbianus columbianus** (Ord.), collected at Kimberley, B. C. (May 5th, 1938, J. B. Poole) and at Waterton Lakes, Alta. (June 27th, 1938, G. P. Holland).

Neopsylla inopina Roths., 1915.
Taken from **Citellus c. columbianus** (Ord.) collected at Kimberley, May 14th, by J. B. Poole.

Rectofrontia fraterna (Baker), 1895.
From **Citellus c. columbianus** (Ord.) at Waterton Lakes National Park, on the boundary of British Columbia and Alberta, June 27th, 1938, by G. P. Holland.

Ctenophyllus terribilis Roths., 1903.
From pika, **Ochotona princeps** ssp. collected at Reno Mountain, Salmo, May 29, 1936 by T. K. Moilliet; at Mt. Dunn, North Thompson Valley, Aug. 11, 1937 by G. P. Holland; and at a rock slide five miles west of Salmon Arm, Aug. 10, 1938, by G. P. Holland.

A series of 36 fleas collected from Norway rats, **Rattus norvegicus** Erxleben, taken September 8th, 1938 at the city dump, Vancouver,

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B. C., proved to be of considerable interest upon study. The following species were found to be present:

23 **Nosopsyllus fasciatus** Bosc., the European rat flea.
4 **Ctenocephalides felis** Bouch., the imported cat flea.
9 **Xenopsylla cheopis** Roths., the Indian rat flea.

In view of the present possibility of plague spreading in southern British Columbia, the record of **Xenopsylla cheopis** R., is of particular interest as this species is the time-honoured carrier and transmitter of bubonic plague to man in the old world and some countries of the new. Its habit of biting avidly even when its gut may be blocked with masses of plague bacilli, and regurgitating cultures of **P. pestis** into the blood of the unfortunate host, makes it the ideal disseminator of this disease and of prime economic importance. A further specimen of this species was secured from a roof rat, **Rattus rattus alexandrinus** (Geoffroy) taken September 8, 1938 in a warehouse at New Westminster, B. C.

N. fasciatus Bosc. and **C. felis** Bouch., both of which bite man readily are not so celebrated, but have been shown to transmit plague from rat to rat under laboratory conditions.

It should be noted that Wagner (Can. Ent., Sept. 1936) suspected that **N. inopina** Roths., **R. fraterna** (Baker) and **C. terribilis** Roths. would eventually be found in British Columbia as they are recorded in Alberta.

Acknowledgements:

I am indebted to Dr. M. A. Stewart of the University of California at Davis for confirmation of the determinations of the rat fleas.

The fleas collected from Columbia ground squirrels were identified by Mr. F. M. Prince at the direction of Dr. C. R. Eskey of the United States Public Health Service, San Francisco, California.

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SOME FOOD PLANTS OF LEPIDOPTEROUS LARVAE (List No. 7)

by J. R. J. Llewellyn Jones*

In presenting this seventh list my thanks are again due to those members who have furnished data included herein.

It is to be noted that in this and subsequent lists the nomenclature adopted is that of Dr. J. McDunnough's new "Check List of the Lepid optera of Canada and the United States of America" Part I. Macrolepidoptera (1938) and Part II. Microlepidoptera (1939).

The following is a list of signs and abbreviations used in this list: G. J. S.—Professor G. J. Spencer, Department of Zoology, University of British Columbia, Vancouver, B. C.

R. G.—Mr. R. Glendenning, Dominion Entomological Laboratory, Agassiz, B. C.

J. R. J.—Mr. J. R. J. Llewellyn Jones, "Arranmore," Cobble Hill, B. C.

An asterisk (*) denotes that the species has been mentioned before in these lists, and that the information now given is either additional or is an amplification of what has been previously reported.

RHOPALOCERA

Lycaena helloides Bdv.—swamp knotweed (**Polygonum amphibium** L.) (G.J.S.)

HETEROCERA

***Acronicta (Apatela) radcliffei** Haw.—quince and greengage plum. (J.R.J.)

Acronicta (Apatela) grisea revellata Sm.—willows (**Salix Scouleriana** (Hook) Barr., and **Salix Hookeriana** Barr.) and garden species of willow. (J.R.J.)

***Acronicta funeralis** G. & R. (**Apatela funeralis** G. & R.)—**flowering** plum (**Prunus cerasifera** Bliriana) (J.R.J.)

***Acronicta (Apatela) distans dolorosa** Dyar.—rose, wild and garden species. (J.R.J.)

***Amphidasis cognataria** Gn.—sumac (**Rhus typhina** L.) (J.R.J.)

***Campaea perlata** Gn.—june-berry (**Amelanchier florida** Lindl.) (J.R.J.)

***Celerio lineata** Fabr.—northern willow herb (**Epilobium adenocaulum** Haussk.) (J.R.J.)

Cerura occidentalis gigans McD.—black willow (**Salix Lasiandra** Benth.) (J.R.J.)

Cerura scolopendrina pluvialis Dyar—willows (**Salix Scouleriana** (Hook.) Barr., and **Salix Lasiandra** Benth.), also on garden species of willow and on poplars (J.R.J.)

***Cymatophora fasciata** B. & McD.—june-berry (**Amelanchier florida** Lindl.) (J.R.J.)

***Diacrisia pteridis rubra** Neum.—ocean spray (**Spirea discolor** Pursh.), bracken (**Pteris aquilina** L.) (J.R.J.

***Diacrisia virginica** Fabr.—elder (**Sambucus callicarpa** Greene) (J.R.J.)

* Cobble Hill, B.C.

Eucosma derilicta Heinr.—Michaelmas daisy, in the roots (R.G.)
***Halisidota maculata angulifera** Wlk.—red flowered currant (**Ribes sanguineum** Pursh.) (J.R.J.)
Lycanades (Xanthia) pulchella Sm.—alder (**Alnus rubra** Bong.), willow (**Salix Scouleriana** (Hook.) Barr.), red flowered currant (**Ribes sanguineum** Pursh.), wild cherry (**Prunus emarginata** Dougl.), bird cherry (**Nuttallia cerasiformis** T. & G.), juneberry (**Amelanchier florida** Lindl.) (J.R.J.)
***Malacosoma pluvialis** Dyar.—wild gooseberry (**Ribes divaricatum** Dougl.), black hawthorn (**Crataegus brevispina** Dougl.) (J.R.J.)
Mineola, species of—Cotoneaster sp. (R.G.)
Paonias excaecata A. & S.—black hawthorn (**Crataegus brevispina** Dougl.) (J.R.J.)
Pyrrhia umbra experimens Wlk.—black poplar (J.R.J.)
Schizura ipomoeae Dbldy—june-berry (**Amelanchier florida** Lindl.) (J.R.J.)
***Schizura unicornis** A. & S.—willows (**Salix Scouleriana** (Hook.) Barr., **Salix Hookeriana** Barr.), crab apple, garden species "Aldenhamensis" (J.R.J.)
***Selenia alciphearia** Wlk.—black hawthorn (**Crataegus brevispina** Dougl.) (J.R.J.)
***Stilpontia salicis** Linn.—aspen (**Populus tremuloides** Michx.) (J.R.J.)

A BRIEF NOTE ON AN ATTEMPT TO HYBRIDIZE NOTOLOPHUS ANTIQUA BADIA HY. EDW. AND HEMEROCAMPA PSEUDOTSUGATA McD.

by J. R. J. Llewellyn Jones*

On September 1st, 1936 a female of **Hemerocampa pseudotsugata** McD. emerged in a breeding cage, and it was noted that in addition to three males of this species, six males of **Notolophus antiqua badia** Hy. Edw. were in attendance on the virgin female. The same phenomenon was also noted the following season, September 1937, when breeding a series of **Hemerocampa pseudotsugata.**

It was thereupon decided to attempt to mate a female **Hemerocampa pseudotsugata** with a male **Notolophus antiqua badia,** so several males of this latter species were introduced into the cage with a virgin female. Though the insects were not actually seen "in copula", fertile eggs were laid on the evening of September 7th, 1937, the day upon which the female had emerged from the cocoon.

The ova hatched the following spring between April 27 and May 7, 1938. The young larvae were blackish and clothed somewhat scantily with black hairs.

The "pabula" of both parent species were offered and the young larvae chose the food plants of the male parent, **antiqua badia,** refusing

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Douglas fir, the usual food of **pseudotsugata.** Of the hosts chosen, preference was shown for **Ribes sanguineum** Pursh., **Salix Scouleriana** (Hook.) Barr., and the garden varieties of rose. The larvae were sleeved on the **Ribes** and **Salix** and fed readily on these until mature. Pupation took place about June 22, 1938. Fourteen pupae were obtained, and from these three males and one female emarged on July 4, 1938, and one other male on July 6; no additional imagines were recovered. On examination it was found that moths had formed within the remaining pupae, but had failed to emerge. This peculiarity had been noted also when breeding a series of **Hemerocampa pseudotsugata** the preceding season. It is suggested that possibly unfavorable weather conditions at the time when the insects were due to appear may have been the cause of the high rate of mortality at this stage.

MATING: Male **Notolophus antiqua badia**
Female **Hemerocampa pseudotsugata**

MATURE LARVA: The mature larva is very similar to that of **antiqua badia** and would, if found at large, undoubtedly be mistaken for that species, with which it agrees as to size and general characteristics. The head is black and shining. The body is blackish and is covered with short yellowish hairs, having a few longer black hairs interspersed and arising from warts. There are four yellowish tufts of hair reminiscent of shaving brushes on the back of segments five to eight, followed by three sets of three orange-red spots on the three following segments. There is a backward pointing black tuft on segment twelve, and two similar tufts, also black in colour, pointing forward on segment two. On each side of the body is a row of 7 orange-red dots. A yellow stripe runs low down on each side near the spiracles. The legs, claspers, and underside of the body are greenish yellow.

PUPA: This is contained in a loose cocoon, is blackish and somewhat hairy, and in general appearance follows the normal "Tussock" moth pupa.

IMAGINES: The male is in form very like the corresponding male parent, **pseudotsugata,** but is somewhat paler. It has on the primaries the white dot so characteristic of **antiqua badia,** but better defined and more prominent than in **pseudotsugata** where it is indistinct. The female, which is apterous, resembles closely the female of **antiqua badia** but in the single specimen obtained is considerably smaller than the normal size for that species.

It may be noted, in conclusion, that the moths obtained, in this instance at any rate, possessed an inverse likeness to their parents.

ECTOPARASITES OF BIRDS AND MAMMALS OF BRITISH COLUMBIA

IV: The Parasite of Bats

by G. J. Spencer*

Of a list, recently compiled by Dr. Ian McTaggart Cowan, of the Provincial Museum, of about eighteen species of bats of British Columbia, I have examined specimens of the following, distributed as shown:-

The Little Brown Bat, **Myotis lucifugus** (Le Conte); common in at least the southern part of the Dry Belt.

The Alaskan Little Brown Bat **Myotis lucifugus alascencis** Miller; in Vancouver.

Millers Bat, **Myotis lucifugus saturatus** Miller; in Vancouver.

Silver-haired Bat, **Lasionycteris noctivagans** (Leconte); from Osoyoos, Agassiz and Vancouver.

The Big Brown Bat, **Eptesicus fuscus fuscus** (Beauvois); widely distributed.

Hoary Bat, **Nycteris cinerea** (Beauvois); from Alta Lake and White Rock.

The Lump-nosed Bat, **Corynorhinus rafinesquii townsendi** (Cooper); in the Lower Fraser Valley.

The California Mastiff Bat, **Eumops perotis californica** (Merriam); one record from New Westminster.

From limited numbers of these species, obtained by personal collecting or from others, the following ectoparasites were taken, arranged here somewhat in the order of their frequency of occurrence and numbers:-

MITES

Generally occurring on the wing membranes, not on the bodies of their hosts, are Parasitiid mites, sub-family Spinturnicinae, genus **Spinturnix** (formerly called **Pteroptus**), a genus apparently distributed on bats the world over. In North America many species have been named but, as is common with most mites, few experts are willing to pin a specific name definitely on any specimens submitted. **Spinturnix** is about the ugliest, most bristly and most repulsive mite to be found anywhere. The abdomen is much reduced in the female and is practically wanting in the male. The genus is remarkable because the six-legged larval stage is passed in the body of the mother and the young is already eight-legged when born.

Greatly outnumbering these **Spinturnix** and occurring both on the wing membranes and on the body, are specimens of two much smaller, smoother mites, an undetermined species of **Liponyssus**, and **Ceratonyssus occidentalis** Ewing. Sometimes this latter species occurs in large numbers at the base of the wing membranes. In all cases observed, the mites do not seem to harm their hosts much. I have looked very carefully for lesions or punctures both on the delicate wing membranes and on the body, but have found none.

BED-BUGS

Next in frequency of occurrence is the bed-bug **Cimex pilosellus** Horvath. Upon their return from the south, those of our bats which

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migrate, especially **Eptesicus fuscus,** the Big Brown Bat, often bring back with them from three to ten female bed-bugs which cling to the necks of their hosts by inserting their beaks in the skin. These bugs from the south are always larger than those that breed up here in bats' nests. I cannot say if the bats on returning south carry a supply of the small northern-bred bed-bugs with them, clinging in the fur. During the summer months in this Province, one never finds a bed-bug clinging to a bat away from its nest; how then do the southern bugs know that the bats are going north? If the reverse was the case, it would probably be a temperature reaction brought on by increasing cold. From an abandoned dugout cellar on a farm between Lytton and Lillooet, I once took a colony of **C. pilosellus** from a nest of **E. fuscus** whose nest in turn was immediately below that of a colony of the subterranean termite **Reticulotermes hesperus** Banks. The bed-bugs were living in the honey-combed substance of the termites' nest whence I obtained many eggs, all stages of nymphs, and some adults of both sexes.

Where bats form large colonies in buildings, as occurred for several years in a deserted house in Nicola and in a well-known summer lodge beside one of the lakes in the Nicola country, the bed-bugs apparently occur in large numbers and at times overflow from the bats' nests into the rest of the house. Careful enquiries elicited the fact that, although the bugs were a nuisance, they had never attacked human beings. Moreover, they do not seem to harm any of their hosts much because even large bugs leave no noticeable feeding punctures on adults or young, for the bats may be breeding at the time and carrying their young in various stages of development.

I have records of these bugs from the Big Brown Bat, the Little Brown Bat and the Silver-haired Bat.

FLEAS

Fleas are not common on our bats and when present are always few in number. I have records of two species only—**Rhinolophopsylla palposus** Roth—occurring on a Big Brown Bat a Kamloops together with two species of mites, and a couple of records of **Myodopsylla gentilis** J. and R. from Okanagan Landing and from Cowichan, on an undetermined species of bat, probably one of the commoner forms.

PUPIPARA

The last group of ectoparasites I have from bats in this Province, is rarest of all, belonging to the Louse-fly family **Nycteribiidae.** These are small, wingless, flat, long-legged flies having the head carried in a groove on top of the thorax. For twelve years I had only one specimen, given to me by the late Ken Auden in 1925, taken apparently from a Little Brown Bat in the Midday Valley, Nicola. It is **Basilia forcipata** Ferris, reported as being not uncommon on several species of bats in the southern States. However, in 1938, Mr. W. Tomkinson, a pre-medical student of the University, gave me a bat which he had collected in a ward of Essondale Asylum, and which Dr. Ian McTaggart Cowan identified for me as a male **Eumops perotis californica** (Merriam), the California Mastiff Bat. It had on it a lone Nycteribiid which Professor G. F. Ferris considers a new species of **Basilia.** The bat was 1300 miles out of its territory, having been hitherto found in "southern

California and Arizona east into southern Texas, in the Lower Sonoran zone; rather local in its distribution. Only the one species of **Eumops** is found as far north as the United States; this genus is southern in its distribution." (Anthony). It is very common even in California and, so far north of its furtherest recorded limits, it is fitting that it should have flown into a lunatic asylum; it is also fitting that it should have had on it a new species of louse fly.

TICKS

The only record I have of ticks on bats is that of three nymphs, which Dr. R. A. Cooley thinks belong to the genus **Ornithodoros.** If this turns out to be the case, it is the first record of ticks of this genus being found in Canada. The specimens lacked mouth parts, thus preventing specific identification. They were collected by Mr. Tomkinson from the unique California Mastiff Bat, mentioned above.

SUMMARY

From somewhat sketchy collecting from eight out of the eighteen species of bats so far listed from British Columbia, I have recorded the following parasites:-

Mites:	**Spinturnix** sp.
	Liponyssus sp.
	Ceratonyssus occidentalis Ewing.
Bed-bugs:	**Cimex pilosellus** Horvath.
Fleas:	**Rhinolophopsylla palposus** Roth.
	Myodopsylla gentilis J. and R.
Louse Flies:	**Basilia forcipata** Ferris.
	Basilia n. sp. undescribed.
Ticks:	**Ornithodoros** sp.

Without question, intensive collecting in the future will reveal further and more interesting records.

Acknowledgements

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ECTOPARASITES OF BIRDS AND MAMMALS IN BRITISH COLUMBIA

V. Parasites of Domestic Animals (Mammals)

by G. J. Spencer*

If one may define domestic as "pertaining to the place of residence and the person of Man", then I propose to call the following animals domestic:- cattle, horses, sheep, goats, pigs, dogs, cats, rabbits, guinea-pigs, monkeys, white and brown rats, and Man himself. From these animals in this Province I have specimens of the following parasites:-

On Cattle:

Bovicola bovis (Linn.) Ewing's new genus; **(Trichodectes bovis** (Linn.)) **(T. scalaris** Nitzsch), the biting red cattle louse. University herd, 1928; Langley, 1938.

Haematopinus eurysternus (Nitzsch), the short-nosed sucking cattle louse. Milner, 1936; Kamloops, 1938. This louse seems to occur more on bulls than on other cattle.

Neither species is common.

On Horses:

Haematopinus asini (Linn.), the sucking horse louse. Vancouver, 1926; Kamloops, 1938.

Trichodectes equi Linn., **(T. parumpilosus** Piaget), the biting horse louse. Vancouver, 1926.

Horses, as well as cattle, are generally free from lice, although ranchers have etold me that horses that have wintered out on the range sometimes develop tremendous infestations of the biting louse in spring.

On Sheep:

Melophagus ovinus (Linn.), the ubiquitous sheep tick or Ked, is very common and widespread.

Linognathus pedalis (Osborn) **(Haematopinus)**, the sucking sheep foot-louse. This is a curious insect, infesting as it does, only the feet and legs and apparently being prevented from spreading upwards to the body of its host, by the lanolin of the wool. Vancouver, 1925, the only record.

On Goats:

Five species of lice have been recorded from goats in North America, but so far I have encountered only one—**Bovicola caprae** (Gurlt), **(Trichodectes) (T. climax** Nitzsch), the biting louse of goats, which I collected in numbers at Tofino, V.I. in 1926. Small herds of goats are widely kept in southern British Columbia so I suspect that this louse, and possibly several others, are relatively common.

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On Pigs:

Haematopinus suis (Linn.), the sucking hog louse and the only species found on domestic pigs. It is not common on herds of swine in this Province but crops up sporadically and although it is supposed to be most prevalent on thin pigs, it is especially difficult to eradicate from between the great rolls of skin and fat on the necks of boars.

So far I have not encountered, locally, the tremendous outbreaks of fleas that occasionally develop in pig-pens in Ontario.

On Dogs:

I have known dogs all my life, in tropical and temperate climates, but I never met a lousy dog until I came to British Columbia. Here, I have taken **Linognathus setosus** (Olfers) (**Pediculus piliferus** Burm.), the sucking dog louse, which turns up now and then in Vancouver, chiefly on terriers, and **Trichodectes canis** De Geer (**T. latus** Nitzsch), the biting dog louse, which I have encountered three times in the last five years, at Kamloops. In one instance it appeared on a batch of puppies and not on the mother, although she must have infested them in the first place. Curiously enough, in 1938, I had it sent down from Quick, in the Bulkley Valley, on a slab of coyote hide. The sender reported that, that spring, all coyotes around Quick were in a terribly mangy condition, sometimes with only the tail intact. From the slab of skin, I obtained a large number of specimens of this louse, but no mange mites. It seems scarcely possible that swarms of lice could depilate a colony of coyotes, but I could find nothing else in the filthy, matted lumps of fur. In 1939 I was informed by a reputable observer that many coyotes in the Merritt district were not worth hunting, all being "flag-tailed": it is possible that this same louse was concerned.

Ctenocephalides canis (Curtis), and **C. felis** (Bouché), dog and cat fleas respectively, attack all dogs at one time or another; some dogs never seem to be free of them. The cat flea, especially, often becomes a serious pest in Vancouver in homes where fuel sawdust provides the necessary moisture for their development in basements. They persist in some basements during every month of the year.

I find that both species of lice and both species of fleas on dogs, yield most satisfactorily to a wash of the derris powder that is compounded for treating warbles in cattle, at a strength of one heaping dessert spoonful to one gallon of warm water: the animals do not seem irritated by the wash.

Otodectes (Chorioptes) cynotis (Hering) var. **canis** Sewell, the ear mite, occurs not infrequently in long-eared or flop-eared dogs, such as spaniels and retrievers. Any dog that sits whining and slowly scratching at his ears is almost certain to have these mites. I have seen valuable retrievers partially or completely deafened by them. The mites produce what is commonly called canker of the ear. Treatment for these minute, slow-moving, globular, white mites consists of swabbing out the ear with cotton wool on the end of a flexible little stick in order to remove accumulations of wax and the dead bodies and cast skins of

the mites, and then with an eye-dropper, pouring in a few cubic centimetres of the following mixture:-

Beta-napthol	1 gram
Ether	3 c.c.
Castor Oil	10 c.c.

The mixture should be made to reach all parts of the ear by manipulation of the base of the ear.

On Cats:

I have taken both dog and cat fleas, but chiefly the latter. I venture to say that every cat in Vancouver harbours fleas sooner or later, or all the time, and every cat should be treated at intervals with dry derris dust, which is far superior to pyrethrum powder for this purpose. One teaspoonful of powder dusted over a cat at night, chiefly along the back and worked well into the fur, will completely rid the beast of its fleas by next morning. The powder makes some cats sneeze badly, so should be carefully applied when near the neck and top of the head: it does not seem to irritate the skin. At the same time, the basement floor should be completely covered with fumes of creosote oil (costing about 80 cents per gallon, retail) pumped vigorously through a good fly sprayer, or the animals will become re-infested in a week's time. One pint of creosote oil is enough for the average cellar.

Otodectes cynotis (Hering) var. **felis** Huber, the cat ear mite, is very general on cats in this city and, like fleas, occurs again and again. The naphthol treatment as for dogs, works perfectly with cats, but must be more carefully administererd because some cats put up a tremendous fight if their ears are swabbed out or if liquid is poured in. The canker of cats ears produced by these mites, if neglected, may cause swellings the size of pigeons eggs, necessitating the destruction of the animal.

On Rabbits:

Ctenocephalides canis (Curtis), the dog flea, often occurs locally on rabbits, both commercial ones and those kept by children as pets, although probably only as stragglers from dogs.

Haemodipsus ventricosus (Denny) **(Haematopinus),** the sucking louse of the rabbit, can generally be found on rabbits kept by local dealers.

Notoedrus cati var. **cuniculi** Gerlach, the ear mite. What was probably this species occurred once on laboratory rabbits, forming scabs and crusts on the insides of the long ears. This is a mange-producing form almost identical with that of cat mange, but one that is difficult to transmit from the cat to the rabbit, according to Hirst of the British Museum.

On Guinea-Pigs:

Gyropus ovalis Nitzsch, and **Gliricola porcelli** (Linn.) **(Gyropus gracilis** Nitzsch), are the two biting lice of guinea-pigs. Both species are specific on these animals and occur commonly in Vancouver. The species **ovalis** is larger and broader than the slender **porcelli.**

On Monkeys:

On monkeys kept as pets in homes and on laboratory animals, I have recovered:-

The cat flea, probably as a straggler, and two species of sucking lice, **Pedecinus longiceps** Piaget and **Pedicinus eurygaster** (Burmeister). Specimens that I have of **P. eurygaster** differ in certain definite respects from the precise descriptions of that master-draughtsman, Ferris, but the genitalia of the male are practically identical. Professor Ferris very kindly checked over my material and states that the form is very variable but that my specimens are this species.

Monkeys are perpetually scratching themselves and hunting what are usually spoken of as fleas, but judging from the severity of the infestations that have come to my notice, it is likely that they suffer mainly from lice and not from fleas.

On Rats:

There are three species of wild rats in the city of Vancouver but I have examined only **Rattus rattus norvegicus** (Erxl.), the Norway rat, and from it I have taken three parasites:-

Polyplax spinulosa (Burm.), the sucking louse of rats.
Ceratophyllus fasciatus Bosc., the common rat flea.
Liponyssus bacoti (Hirst), the common rat mite.

White rats, maintained in the laboratory, occasionally develop sporadic outbreaks of **Polyplax spinulosa** (Burm.), the sucking louse. Since some individuals only become infested, it seems probable that the source of infection is brown rats which have eaten their way into the rat house.

On Man:

The two races of **Pediculus humanus** Linn., namely, **capitis** De Geer and **corporis** De Geer, the head louse and body louse respectively, of Man, and **Phthirus pubis** (Linn.), the crab-louse, are present in Vancouver at all times although their occurrence is sporadic. They are reported chiefly to doctors of the outpatients wards of local hospitals. Derris powder, either dry or as a saponified wash, is highly efficient against all three and will probably soon supplant all other treatments.

Pulex irritans Linn., the human flea, is slowly but surely spreading in Vancouver. It occurs throughout the year but is especially abundant in autumn months. One report concerned an outbreak on two hundred yards of beach at a summer resort on Vancouver Island. Fleas from such an infestation could very well be carried to homes in all directions.

Ctenocephalides canis (Curt.), the dog flea, and **C. felis** (Bouché), the cat flea, in homes in the city, have already been discussed.

SUMMARY

On eleven mammals, more or less domestic in British Columbia, occur twenty-four species of parasites consisting of nine sucking lice, seven biting lice, three fleas, four mites, and one bird-louse; man brings into the picture three more sucking lice and one flea, making twelve mammals with twenty-eight parasites. Several lice and fleas, recorded elsewhere, have been omitted from the list, and mice have not been considered at all as the list of their parasites is not yet complete. When complete, the list of parasites on domestic animals in this Province will approximate forty species.

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